

May 11, 2006

TO: D. Morris
FROM: S. Chhan
SUBJECT: NHPC Supportability Study

The Resource Allocation Planning Service (RAPS) has completed a study to analyze the supportability from the DSN 70-Meter subnet and any impacts to other DSN users if the NHPC Mission increases a Telemetry Tracking pass on the DSN 70-Meter subnet. The NHPC Mission requested to add a Telemetry Tracking pass once a month, requiring eight hours with a minimum of four hours from week 11 year 2008 through week 42 year 2014. This Telemetry Tracking pass on certain occasion will also function as a beacon support for NHPC Mission in which the Project will allocate the best time to perform these events in weeks with the best percentage of supportability and the least contention on the 70-Meter subnet.

Although the NHPC Mission requested that an analysis of supportability to be forecasted on a monthly basis, RAPS found it to be more precise to analyze on a weekly basis to pinpoint the weeks with low percent of supportability. This study includes supportability percentage with the added Telemetry Tracking pass compared to support without the Telemetry Tracking pass on the DSN 70-Meter subnet starting from week 11 year 2008 through end of year 2014 although the request was for up to week 42 year 2014.

Summary of Results

An analysis on the supportability of NHPC on the 70-Meter subnet with or without the addition of one 8-hour NHPC Telemetry Tracking pass resulted in minor impacts to the DSN 70-Meter subnet supportability for the NHPC Mission. However, after analyzing the viewperiod of other DSN users on the 70-Meter subnet, NHPC Mission will encounter various contentions for years 2008 and minor contentions in year 2009. The supportability percentage for NHPC Mission from beginning of year 2010 through end of year 2014 indicated a 90% average supportability and very little contentions with other DSN users at this point in time when the forecast was generated.

This study focuses on the low supportability percentage for NHPC dipping below the 80% mark with an additional NHPC Telemetry Tracking pass on the 70-Meter subnet in years 2008-2009. Although the study was requested to start on year 2008 week 11, an important period was noted from beginning of year 2008. The period from weeks 1 – 12 in year 2008, the ULYS Nutation and North Polar event caused heavy contention on the 70-Meter subnet resulting in supportability of NHPC to dip from 78% in week 1 to as low as 69% in week 8. The analysis of NHPC viewperiods shows overlapping with other DSN users' viewperiods on the 70-Meter subnet, which this report will further illustrate.

The following are highlights of specific weeks in year 2008 that are in heavy contention for the 70-Meter subnet, which resulted in the low supportability of NHPC with an additional Telemetry Tacking pass:

- Supportability average of 70% for weeks 21 and 22 due to the viewperiod overlap with CAS, M01O, MGS, MEX, MRO, STF, VGR1, and PHX Approach, Trajectory Correcction Maneuver, and Entry Descent Landing phase.
- Supportability average 77% for weeks 33 and 34 due to contentions and overlapping of viewperiod with ULYS, Mars Missions, and VGR1.
- Week 46 showed 54% supportability on the 70-Meter subnet due to DSS-43 approved scheduled downtime. The other factor is NHPC viewperiod overlapping withVGR1, ULYS, MEX, MGS, M01O, MRO, and STF averaging a total of 80% overlap. M01O solar conjunction period may contribute to the effect.
- Weeks 47 through 52 indicates an average supportability of 77%, which is due to contentions with STF, M01O, CAS, MGS, MRO, VGR2, ULYS, SOHO keyhole, and DSS-43 downtime for Life Extension from week 40 year 2008 through week13 year 2009.

The following are highlights of specific weeks in year 2009 that are in heavy contention for the 70-Meter subnet, which resulted in the low supportability of NHPC with an additional Telemetry Tacking pass:

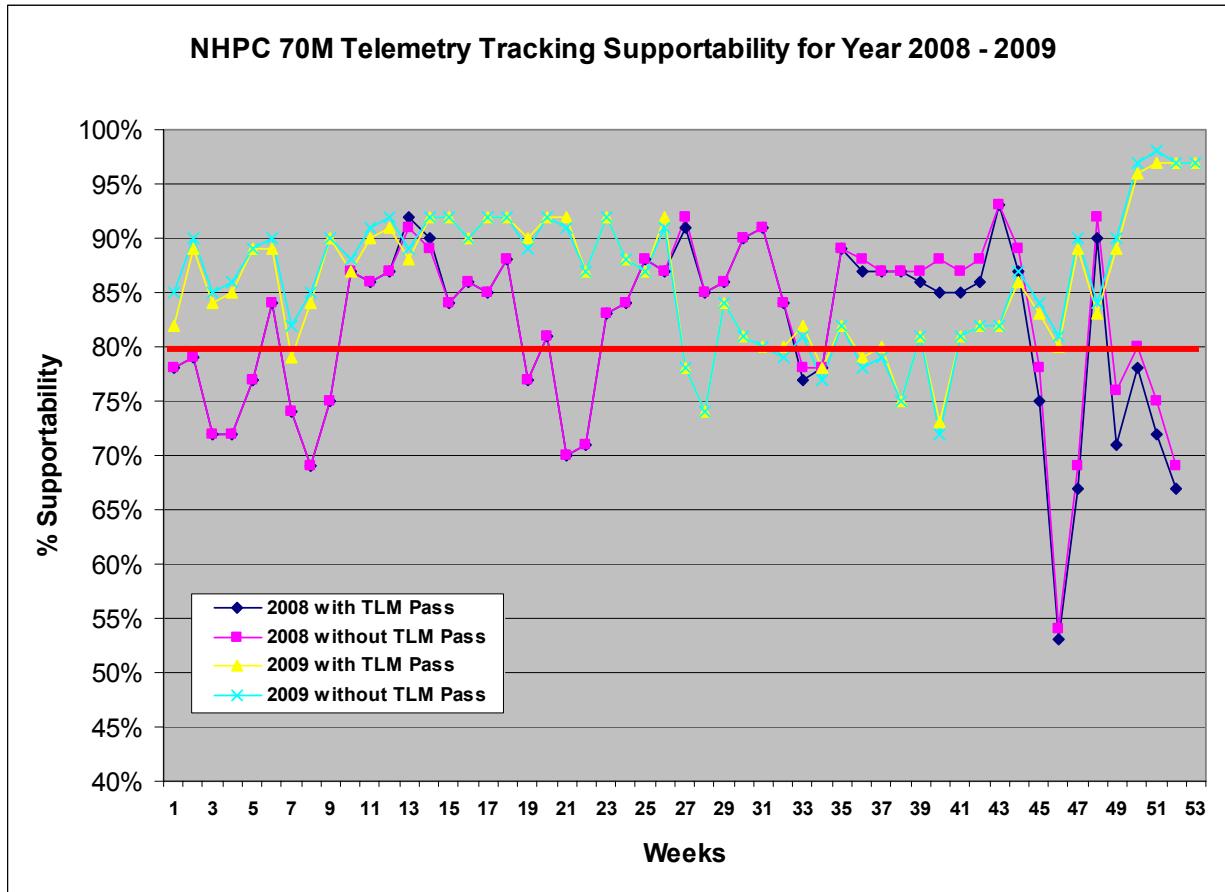
- Supportability for week 27 is 78% and week 28 is 74% due to a slight viewperiod overlap with CAS, MGS, M01O, and DSS-63 Downtime also has a direct impact on the 70-Meter subnet availability.
- Supportability for week 34 is 77%, week 36 is 78%, week 38 is 75%, week 40 is 72% due to viewperiod overlap with CAS on the 70-Meter subnet and because DSS-63 Downtime for Life Extension contribute to the low supportability.

Analysis of Results

Analysis was accomplished by running forecasts for years 2008 – 2014. Prior to running the supportability forecasts, the NHPC User Loading Profile was amended to include one Telemetry Tracking pass per week with 8 hours requirements and 4 hours minimum per pass from week 11 year 2008 through week 42 year 2014. Although the NHPC Mission requirements asked for a forecast and analysis on only one additional 8-hour Telemetry Tracking pass per month, RAPS forecasted and analyzed every week to detect the weeks that may have very low supportability.

Further analysis was performed on weeks that are below 80% supportability. For the weeks that are above 80% supportability, it should be negotiable in the mid-range allocation process. The current mission set was used for this study. The DSN Antenna Downtime Status and Forecast was also used to show the downtimes and critical events that may affect this study relevant to NHPC Mission.

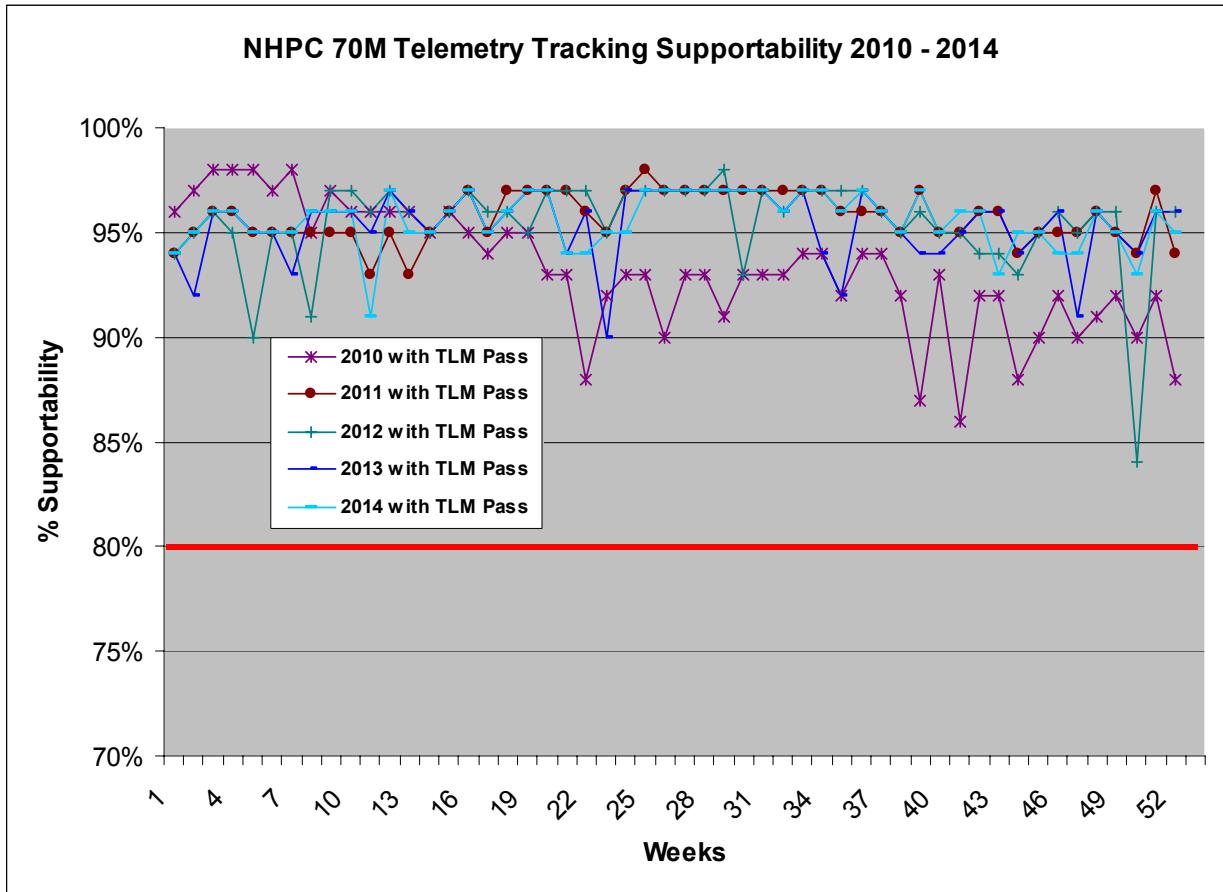
Figure 1: NHPC Telemetry Tracking Supportability on 70-Meter Subnet for Year 2008 – 2009



In figure 1 above, year 2008, the percentage of supportability for week 46 is 54% and for week 52 is 69% due to DSS-43 downtime for antenna life extension and extra heavy viewperiod contentions with various DSN users. Other than the downtime for DSS-43, there are no other foreseeable impacts that NHPC will incur on the 70-Meter subnet by additional Telemetry Tracking pass.

For year 2009, there are minimal impacts on the NHPC with the exception of the viewperiod overlaps and also with the scheduled downtimes for DSS43 occurring in week 40 year 2008 –week 13 year 2009, DSS63 downtime scheduled for week 14 year 2009 through week 39, and DSS-14 is scheduled downtime on week 40 year 2009 through week 12 year 2010.

Figure 2: NHPC Telemetry Tracking Supportability on 70-Meter Subnet for Year 2010 – 2014



In Figure 2 above, from year 2010 through 2014, the NHPC Mission basically will have a very positive supportability percentage above 90%. This analysis shows that NHPC will have no further issues after end of year 2009, taking into consideration that the results of this study are subject to change, in that network loading changes, as requirements for planned missions are input and updated and periods of antenna downtime are identified.

Conclusion

Forecast results for NHPC Project indicates that an additional Telemetry Tracking pass on the 70-meter subnet appears to have no significant difference between adding the Telemetry Tracking pass or without adding the pass from year 2008 – 2014. The only issues that may arise are from new requirements from other DSN users in the near future. However, the study found a high level of contention between NHPC and other DSN users especially during the approved 70-Meter downtimes to occur one after another in the duration of approximately six months apart starting with DSS43.

In 2008, DSS-43 will be unavailable for approved Life Extension downtime from week 40 year 2008 through week 13 of year 2009. The downtime of DSS-43 creates viewperiod overlaps between NHPC and other DSN users trying to get coverage from the 70-Meter subnet.

DSS-63 will begin the Life Extension downtime from week 14 year 2009 through week 39. DSS-14 will start the Life Extension downtime period from week 40 year 2009 through week 12 year 2010.

For NHPC to have better supportability percentage, the Telemetry Tracking pass can be shortened to the minimum of 4 hours per week for the weeks with the lowest percentage of supportability, this is especially critical in weeks with high contentions for the 70-Meter subnet. Otherwise, scheduling around those weeks with the lowest supportability will result in the best support from the DSN 70-Meter subnet.

The following is a recommendation to shorten the Telemetry Tracking pass to a minimum of 4 hours vice 8 hours as initially required for the weeks with the lowest supportability percentage. The weeks for NHPC Mission to work around or simply to reduce the hours of support are as follows; in year 2008 (weeks 21, 22, 33, 34, 46, 47 – 52), and year 2009 (weeks 27, 28, 34, 36, 38, 40). Another recommendation from RAPS is to schedule the Telemetry Tracking pass on those weeks with the highest supportability percentage and utilize the required hours necessary to accomplish NHPC Mission goals.